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MEMORANDUM ON BIG SPRINGS PLANTATION

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The following report is based on an examination of the plantations comprising the Big Springs Reforestation Project, Lassen National Forest, conducted from June 16 to June 21, 1939.

Disease conditions in native reproduction in vicinity

Examination of native ponderosa and jeffrey pine reproduction at several locations surrounding the Big Springs plantation showed the young trees to be generally in good condition and making good growth. In a few instances heavy infestations of dwarf mistletoe are damaging young trees, but infection is not widespread.

The same weevil (Cylindrocopturus longulus (Lec.)) present on planted stock was found in an occasional young dead pine in the native stands bordering the brushfield. No adult weevils were observed on foliage of living native pines, but needle spots caused by feeding of the insect showed that failure to observe the weevil on living trees was apparently due only to relative scarcity of the insect. Needle spotting was quite rare in native stands compared to its occurrence on planted stock, however. Weevils, with accompanying needle spots, were very common on one native 6-8 year old seedling growing in between the rows in the brushfield plantation. In the planted row just south of the above seedling two 1934 seedlings were dead, and on examination proved to be infested with weevils and blue stain.

Some dying of young native reproduction was observed; in one case the symptoms were much like those characteristic of dead and dying trees on the planted area, with weevils and blue stain present in the recently-killed four-foot pine. In several instances a root rot was apparently involved in death of young native seedlings, but this was not found to be common.

A blue-staining fungus resembling that found in all dead planted stock is common in small dead ponderosa and jeffrey pines and in dead branches at least of older pines in the vicinity of the Big Springs plantation. Isolations made from both planted and native diseased seedlings yielded the blue-staining organism Hormiscium gelatinosum Hedgc. The fungus was also found near the Burney Spring brushfield.

Disease conditions in planted stock

Age and species of trees involved-- The greatest mortality was found to be in the oldest stock on the plantation, ranging from 1932-1934 planting, as reported by Mr. Horn and Mr. Corson. One dead seedling exhibiting the same symptoms was found in the 1937 stock west of the highway; damage is practically negligible to date in stock of this age. Both ponderosa and jeffrey pines are apparently about equally damaged.

Symptoms in diseased trees--The stems of entirely dead seedlings, from the top to near ground level, contain numerous adult weevil emergence holes and larval tunnels, and the wood is always heavily stained by the blue-staining fungus. Stain is not always present over the entire region covered by weevil borings; some of the wood in which weevils have been working may be entirely free from stain. Stain was always found near the lower limits of weevil infestation, however. Dead needles on such entirely dead seedlings usually showed needle spots caused by feeding of weevils.

In trees only partially killed back, symptoms are similar down to the girdled stem area. Below the point where the stem is girdled the cortex is usually a dark brown color for varying distances down the stem, with the wood unstained and apparently healthy. The cortical discoloration may be patchy or it may be continuous for some distance below the girdled region and may extend nearly around the stem. Drops of resin are often present on the green portion of the stem.

In several instances pockets containing dark-colored fungus mycelium were found in the discolored, resin-impregnated cortex. These appeared at the bases of dead needles, indicating that the fungus may possibly have entered through these needles. The fact that the blue-staining fungus (Hormiscium gelatinosum) has been isolated by Dr. Rumbold from needles spotted by feeding of the weevil would seem to be significant in relation to this point. However a fungus of this wood-staining type would not normally be expected to grow through green needle tissue and cause diseased areas in a healthy cortex.

Larvae, apparently those of Cylindrocopturus longulus, were also found occasionally in these discolored cortical patches; at times they were found in small brown patches of cortex entirely surrounded by green cortical tissue. These discolored cortical areas are often evident on cutting into a stem which appears healthy--on trees in which some killing has taken place in the upper parts. Larvae were also found boring in apparently healthy wood, on a young stem still bearing green needles, but with dead tissue immediately above.

Adult weevils were present in large numbers on green tissues of all trees which had been partly killed back (mid-June) and occasionally were seen on entirely dead trees--usually they had entirely abandoned dead trees, however. Needle spotting was common on remaining green needles of partly-killed trees. Weevils, with accompanying needle-feeding spots and drops of resin on the stems, were also abundant on living trees in close proximity to dead or declining seedlings.

In one case a young dead planted seedling was found to have abundant blue stain but no evidence of weevils. In a contrary instance a young branch tip of a 1934 seedling was dead; on examination weevils were found to be present but there was no sign of blue stain. Otherwise the two organisms were universally associated in diseased seedlings.

The roots of affected trees were found to be healthy, with good root distribution and depth. In one instance a large larva was discovered boring in the root crown; this was too rare to be of any consequence in relation to damage in the area, however. Blue stain and weevil activity occasionally extended down into the roots on trees which had been dead for a considerable period.

Distribution of affected stock--No apparent relation could be discovered between soil conditions or evidence of subsoil variation and death of trees. Distribution of affected trees is apparently haphazard, with damage fairly well scattered through the larger tree classes. If the weevil is responsible for initiating attack on the seedlings, the occurrence of affected specimens might be expected to be by chance--wherever the insect happened to fly or be blown by wind. Possibly the explanation for death mainly in the older stock is that these seedlings are much larger than the later (1937) planting and therefore offer a larger target on which weevils might alight.

In one case diseased planted stock was found within 150 feet of a dead, weevil-infested, blue-stained natural seedling in the native stand surrounding the brushfield. The insects may very well have moved from such native seedlings out into the brushfield. Why they did so and why the results are so disastrous and widespread in the planted seedlings is a question that will require considerable more investigation.

The question of lack of adaptability of the planted stock to the site has been raised. The finding of diseased and dead native seedlings (which had been making good growth) out in the same brushfield as well as in the native stand would appear to lessen the importance to be placed on this phase.

Disease conditions in planted stock at Burney Spring

A brief examination of some of the planting on the Burney Spring brushfield disclosed no evidence of weevils, but two recently deceased seedlings were found which were apparently healthy except for a small area near the ground level. In this area of the stem the cortex was discolored and the wood stained similar to that of dead stock at Big Springs. Here apparently, the blue-staining organism was acting independently of the insect.

Tentative conclusions

As the larvae of Cylindrocopturus longulus have been found working in tissues not yet killed, this insect may be the primary agent in initiating decline of the seedlings.

The universal occurrence of the blue-staining organism

(Hormiscium gelatinosum) in conjunction with the weevil, and its possible presence in the cortex below girdled areas raises the question of possible pathogenicity of this fungus, which it might be well to test by inoculation work. Independent action of the fungus in the case of a few seedlings further adds to its importance.

The occurrence of both insect and fungus concerned in surrounding native trees makes evident the origin of both pests, but gives no clue to the recent high mortality among the oldest planted stock.

No evidence was found involving environmental (frost, moisture) conditions, soil conditions, or poor vigor of host.

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